CLAIM AMENDMENTS

This listing of claims will replace all prior versions, and listings, of claims in the application.

1 1.   (Previously Presented) A method of determining a placement of services of a
2 distributed application onto nodes of a distributed resource infrastructure comprising
3 the steps of:
4   establishing a placement indicator for a specific service;
5   forming communication constraints between node pairs which ensure that a
6 sum of transport demands between a particular node pair does not exceed a
7 transport capacity between the particular node pair, each term of the sum
8 comprising a product of a first placement variable, a second placement variable,
9 and the transport demand between the services associated with the first and
10 second placement variables;
11   forming an objective; and
12   employing a local search solution to solve an integer program comprising the
13 placement indicator, the communication constraints, and the objective to
14 determine the placement of the services onto the nodes.

1 2.   (Original) The method of claim 1 wherein the placement indicator comprises a
2 pre-defined placement.

1 3.   (Original) The method of claim 2 wherein the pre-defined placement comprises
2 placing the specific service onto a specific node.

1 4.   (Original) The method of claim 2 wherein the pre-defined placement comprises
2 not placing the specific service onto a specific node.

1 5.   (Original) The method of claim 1 wherein the placement indicator comprises a
2 neutral indication of whether the specific service is to be placed onto a specific node.

1 6.   (Previously Presented) A method of determining a placement of services of a
2   distributed application onto nodes of a distributed resource infrastructure comprising
3   the steps of:
4   establishing an application model of the services comprising transport
5   demands between the services;
6   establishing an infrastructure model of the nodes comprising transport
7   capacities between the nodes;
8   establishing a placement model comprising placement indicators for the
9   services;
10   forming an integer program that comprises:
11   a set of placement variables for a combination of the services and the
12   nodes, each of the placement variables indicating whether a particular service
13   is located on a particular node;
14   communication constraints between node pairs which ensure that a sum of
15   the transport demands between a particular node pair does not exceed the
16   transport capacity between the particular node pair, each term of the sum
17   comprising a product of a first placement variable, a second placement
18   variable, and the transport demand between the services associated with the
19   first and second placement variables;
20   placement constraints for the services which ensure that the services are
21   placed onto the nodes in accord with the placement indicators; and
22   an objective; and
23   employing a local search solution to solve the integer program which
24   determines the placement of the services onto the nodes.

1 7.   (Original) The method of claim 6 wherein a particular placement indicator
2   comprises an indication that a specific service is to be placed onto a specific node.

1 8.   (Original) The method of claim 6 wherein a particular placement indicator
2   comprises an indication that a specific service is not to be placed onto a specific node.

1   9.   (Original) The method of claim 6 wherein a particular placement indicator

2   comprises a neutral indication of whether a specific service is to be placed onto a

3   specific node.

1   10.   (Original) The method of claim 9 wherein a default for the placement indicators

2   comprises the neutral indication.

1   11.   (Previously Presented) A method of determining a placement of services of a

2   distributed application onto nodes of a distributed resource infrastructure comprising

3   the steps of:

4   establishing an application model of the services that comprises processing

5   demands for the services, storage demands for the services, and transport

6   demands between the services;

7   establishing an infrastructure model of the nodes that comprises processing

8   capacities for the nodes, storage capacities for the nodes, and transport capacities

9   between the nodes;

10   establishing a placement model comprising placement indicators for the

11   services;

12   forming an integer program that comprises:

13   a set of placement variables for a combination of the services and the

14   nodes, each of the placement variables indicating whether a particular service

15   is located on a particular node;

16   processing constraints which ensure that a sum of the processing demands

17   for each of the nodes does not exceed the processing capacity for the node;

18   storage constraints which ensure that a sum of the storage demands for

19   each of the nodes does not exceed the storage capacity for the node;

20   first placement constraints which ensure that each of the services is placed

21   on one and only one node;

22   second placement constraints which ensure that the services are placed

23   onto the nodes in accord with the placement indicators;

24   communication constraints between node pairs which ensure that a sum of

25   the transport demands between a particular node pair does not exceed the

26   transport capacity between the particular node pair, each term of the sum

27   comprising a product of a first placement variable, a second placement

28   variable, and the transport demand between the services associated with the

29   first and second placement variables; and

30   an objective of minimizing communication traffic between the nodes and

31   balancing processing loads on the nodes; and

32   employing a local search solution to solve the integer program which

33   determines the placement of the services onto the nodes.

1 12. (Previously Presented) A computer readable memory comprising computer code

2   for directing a computer to make a determination of a placement of services of a

3   distributed application onto nodes of a distributed resource infrastructure, the

4   determination of the placement of the services onto the nodes comprising the steps of:

5   establishing a placement indicator for a specific service;

6   forming communication constraints between node pairs which ensure that a

7   sum of transport demands between a particular node pair does not exceed a

8   transport capacity between the particular node pair, each term of the sum

9   comprising a product of a first placement variable, a second placement variable,

10   and the transport demand between the services associated with the first and

11   second placement variables;

12   forming an objective; and

13   employing a local search solution to solve an integer program comprising the

14   placement indicator, the communication constraints, and the objective to

15   determine the placement of the services onto the nodes.

1 13. (Original) The computer readable memory of claim 12 wherein the placement

2   indicator comprises a pre-defined placement.

1 14. (Original) The computer readable memory of claim 13 wherein the pre-defined

2   placement comprises placing the specific service onto a specific node.

1   15.   (Original) The computer readable memory of claim 13 wherein the pre-defined

2   placement comprises not placing the specific service onto a specific node.

1   16.   (Original) The computer readable memory of claim 12 wherein the placement

2   indicator comprises a neutral indication of whether the specific service is to be placed

3   onto a specific node.

1   17.   (Previously Presented) A computer readable memory comprising computer code

2   for directing a computer to make a determination of a placement of services of a

3   distributed application onto nodes of a distributed resource infrastructure, the

4   determination of the placement of the services onto the nodes comprising the steps of:

5   establishing an application model of the services comprising transport

6   demands between the services;

7   establishing an infrastructure model of the nodes comprising transport

8   capacities between the nodes;

9   establishing a placement model comprising placement indicators for the

10   services;

11   forming an integer program that comprises:

12   a set of placement variables for a combination of the services and the

13   nodes, each of the placement variables indicating whether a particular service

14   is located on a particular node;

15   communication constraints between node pairs which ensure that a sum of

16   the transport demands between a particular node pair does not exceed the

17   transport capacity between the particular node pair, each term of the sum

18   comprising a product of a first placement variable, a second placement

19   variable, and the transport demand between the services associated with the

20   first and second placement variables;

21   placement constraints for the services which ensure that the services are

22   placed onto the nodes in accord with the placement indicators; and

23   an objective; and

24   employing a local search solution to solve the integer program which

25   determines the placement of the services onto the nodes.

1   18.   (Original) The computer readable memory of claim 17 wherein a particular

2   placement indicator comprises an indication that a specific service is to be placed

3   onto a specific node.

1   19.   (Original) The computer readable memory of claim 17 wherein a particular

2   placement indicator comprises an indication that a specific service is not to be placed

3   onto a specific node.

1   20.   (Original) The computer readable memory of claim 17 wherein a particular

2   placement indicator comprises a neutral indication of whether a specific service is to

3   be placed onto a specific node.

1   21.   (Original) The computer readable memory of claim 20 wherein a default for the

2   placement indicators comprises the neutral indication.

1   22.   (Original) The computer readable memory of claim 20 wherein a matrix is

2   specified which expresses constraints or preferences for identifying a placement of

3   services onto nodes.

1   23.   (Previously Presented) A computer readable memory comprising computer code

2   for directing a computer to make a determination of a placement of services of a

3   distributed application onto nodes of a distributed resource infrastructure, the

4   determination of the placement of the services onto the nodes comprising the steps of:

5   establishing an application model of the services that comprises processing

6   demands for the services, storage demands for the services, and transport

7   demands between the services;

8   establishing an infrastructure model of the nodes that comprises processing

9   capacities for the nodes, storage capacities for the nodes, and transport capacities

10   between the nodes;

11   establishing a placement model comprising placement indicators for the

12   services;

13   forming an integer program that comprises:

14   a set of placement variables for a combination of the services and the

15   nodes, each of the placement variables indicating whether a particular service

16   is located on a particular node;

17   processing constraints which ensure that a sum of the processing demands

18   for each of the nodes does not exceed the processing capacity for the node;

19   storage constraints which ensure that a sum of the storage demands for

20   each of the nodes does not exceed the storage capacity for the node;

21   first placement constraints which ensure that each of the services is placed

22   on one and only one node;

23   second placement constraints which ensure that the services are placed

24   onto the nodes in accord with the placement indicators;

25   communication constraints between node pairs which ensure that a sum of

26   the transport demands between a particular node pair does not exceed the

27   transport capacity between the particular node pair, each term of the sum

28   comprising a product of a first placement variable, a second placement

29   variable, and the transport demand between the services associated with the

30   first and second placement variables; and

31   an objective of minimizing communication traffic between the nodes and

32   balancing processing loads on the nodes; and

33   employing a local search solution to solve the integer program which

34   determines the placement of the services onto the nodes.